THE PROCEEDINGS OF THE PHYSICAL SOCIETY

FROM JANUARY 1939 TO NOVEMBER 1939

VOLUME 51

Published by
THE PHYSICAL SOCIETY
1 Lowther Gardens, Exhibition Road
London, S.W. 7

Printed at
THE UNIVERSITY PRESS, CAMBRIDGE

12307

PRINTED IN GREAT BRITAIN

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Editor of the Proceedings:

Capt. C. W. HUME, M.C., B.Sc.

Assistant Secretary:

Miss J. I. DENNIS

CONTENTS

Part 1. 2 *January* 1939

PAGE

PROF. A. V. HILL. The transformations of energy and the mechanical work of muscles 1

E. E. WIDDOWSON. The relation between range and energy for the upper limits of β-ray spectra 19

A. NUNN MAY. The extinction of discharges in Geiger-Muller counters . . . 26

L. F. BATES and G. G. TAYLOR. Ferromagnetic compounds of chromium . . . 33

N. F. ASTBURY and L. H. FORD. The precision measurement of capacitance . 37

J. E. R. CONSTABLE. Transmission of sound between neighbouring rooms in a brick building 53

A. K. SEN GUPTA. Rotational analysis of the ultra-violet bands of germanium monoxide 62

G. W. BRINDLEY and P. RIDLEY. The characteristic temperature of magnesium oxide 69

G. W. BRINDLEY and P. RIDLEY. An x-ray investigation of atomic vibrations in cadmium 73

E. V. APPLETON, R. NAISMITH and L. J. INGRAM. The critical-frequency method of measuring upper-atmospheric ionization 81

S. CHAPMAN. The atmospheric height distribution of band-absorbed solar radiation 93

T. L. ECKERSLEY and G. MILLINGTON. The limiting polarization of medium waves reflected from the ionosphere 110

J. H. PIDDINGTON. The origin of radio-wave reflections in the troposphere . . 129

M. V. WILKES. Theoretical ionization curves for the E region 138

L. J. COLLIER, W. S. STILES and W. G. A. TAYLOR. The variation with temperature of the electrical resistance of carbon and graphite between 0° C. and 900° C. . 147

R. W. POWELL and F. H. SCHOFIELD. The thermal and electrical conductivities of carbon and graphite to high temperatures 153

S. WHITEHEAD and W. HACKETT. Measurement of the specific inductive capacity of diamonds by the method of mixtures 173

Reviews of books 191

Part 2. 1 *March* 1939

L. C. TYTE. The rate of viscous flow of metals. Part 2: lead 203

G. P. BARNARD. The spectral sensitivity of selenium rectifier photoelectric cells . 222

R. JACKSON and A. G. QUARRELL. Apparatus for electron-diffraction at high temperatures 237

D. BROWN. Acoustic spectra obtained by the diffraction of light from sound films 244

M. BOUND and D. A. RICHARDS. A study of the atmospheric oxidation of metals and alloys at different temperatures by electron-diffraction 256

R. F. BARROW. Ultra-violet band systems of silicon monoselenide and monotelluride 267

W. W. BARKAS. Analysis of light scattered from a surface of low gloss into its specular and diffuse components 274

O. KLEMPERER and W. D. WRIGHT. The investigation of electron lenses . . . 296

PAGE

C. W. Oatley. The adsorption of oxygen and hydrogen on platinum and the removal of these gases by positive-ion bombardment 318

H. G. Howell and G. D. Rochester. The band spectrum of antimony fluoride (SbF) 329

L. F. Broadway and A. F. Pearce. Emission of negative ions from oxide cathodes 335

J. R. Bristow. The conductivity of thin films of thallium on a pyrex glass surface 349

R. L. Sen Gupta. The scattering of fast β particles by xenon nuclei 355

Discussion on electroacoustics 359

Discussion: The investigation of electron lenses 376

Reviews of books 378

Part 3. 1 *May* 1939

Sir Ambrose Fleming. Physics and the physicists of the eighteen-seventies . 383

J. A. Fleming. March 21, 1874. I. On the new contact theory of the galvanic cell 393

Sir Ambrose Fleming. A new method of creating electrification 402

R. W. Powell. Further measurements of the thermal and electrical conductivity of iron at high temperatures 407

L. F. Bates and J. H. Prentice. The electrical resistance of nickel amalgams . 419

G. P. Thomson and M. Blackman. Theory of the width of rings formed by electron-diffraction 425

G. W. Brindley and P. Ridley. An x-ray study of lattice-distortion in copper, nickel and rhodium 432

M. A. El Sherbini and Y. L. Yousef. The effect of cooling and of magnetic fields on crystal rectification 449

D. Owen. Note on the bar pendulum 456

Eric J. Irons and G. A. Bennett. A falling-weight time switch: its standardization and application to the determination of the time constant of an inductive circuit 459

G. Temple. Relativistic cosmology 465

A. Charlesby, G. I. Finch and H. Wilman. The diffraction of electrons by anthracene 479

G. C. McVittie. Observation and theory in cosmology 529

Albert Campbell. Mutual and self inductors compensated for change of frequency 539

Albert Campbell. Simple demonstration of the Peltier effect with approximate measurement 545

J. H. Piddington. The origin of radio-wave reflections in the troposphere (author's reply to the discussion) 547

D. Brown. Acoustic spectra obtained by the diffraction of light from sound films (discussion) 549

J. Nicol. A simple demonstration of the volta contact E.M.F. 550

W. R. S. Garton. Demonstration of a heavy current hydrogen discharge-tube . 551

Obituary notices:

Sir Robert Mond, F.R.S. 553

George Ellery Hale 555

Dr J. E. R. Constable 556

Reviews of books 557

Part 4. 1 *July* 1939

PAGE

E. H. Mercer. Spreading of paraffin oils containing fatty acids on aqueous solutions of calcium ions 561

R. A. Chipman. Ultra-high-frequency resonances in the positive-grid triode . 566

B. R. A. Nijboer. On the theory of electronic semi-conductors 575

D. H. Follett. Comparison of cosmic-ray showers underground and at sea-level 585

Irving Langmuir. The structure of proteins 592

Irving Langmuir and Dorothy Wrinch. A note on the structure of insulin . 613

O. Goche and H. Wilman. The structure of silver films 625

J. J. Guest. Shear-stress systems and combined stress 652

C. A. Beevers. A machine for the rapid summation of Fourier series . . . 660

J. C. M. Brentano, Joan Honeyburne and J. K. Berry. Measurements of the intensity-distribution of the white x radiation reflected from a crystal; with a note on the dispersion of the atomic scattering factor of zinc near the *K* absorption edge 668

James Reekie. The sensitivity of photographic films to x radiation at very low temperatures 683

M. Velasco and G. L. Hutchinson. A new method of determining the properties of dielectrics at centimetre wave-lengths 689

M. de Selincourt. The reproducibility of the platinum thermocouple at the freezing points of gold, silver and antimony 695

Major-General M. N. MacLeod. Some recent developments in British surveying instruments 710

N. R. Tawde and S. A. Trivedi. CN and AlO bands in the study of the carbon arc 733

Reviews of books 741

Part 5. 1 *September* 1939

J. A. Ratcliffe. The effect of the Lorentz polarization term in ionospheric calculations 747

J. S. Preston. The relative luminosity of radiation for the average photometric observer (2) 757

H. W. Lee. Oblique refraction through a cylinder 768

A. Balankeswara Rao and S. G. Krishnamurty. The third spark spectrum of krypton, Kr IV 772

L. F. Bates and W. P. Fletcher. The electrical resistance of ferromagnetic amalgams 778

E. N. da C. Andrade. The velocity distribution in a liquid-into-liquid jet. Part 2: the plane jet 784

E. A. Neumann. The influence of the angle of incidence of light on the diffraction of light by supersonic waves 794

Miss M. E. Sutton and A. Harvey. The dispersion of a prism 803

T. L. Eckersley and G. Millington. The experimental verification of the diffraction analysis of the relation between height and gain for radio waves of medium lengths 805

F. A. B. Ward. A mechanical model illustrating the principle of the cyclotron . 810

PAGE

F. H. G. Pitt. The effect of adaptation and contrast on apparent brightness . 817

Mary D. Waller. Vibrations of free square plates: Part 1. Normal vibrating modes 831

B. Cabrera and A. Duperier. Further results on the magnetism of chlorides of the palladium and platinum triads of elements 845

F. W. G. White. The dispersion of wireless echoes from the ionosphere . . 859

F. W. G. White and T. W. Straker. The diurnal variation of absorption of wireless waves 865

F. W. Chapman. Atmospheric disturbances due to thundercloud discharges: part I 876

Reviews of books 895

Part 6. 1 *November* 1939

T. H. Oddie. The gamma-ray measurement of radium 905

J. Bor, A. Hobson and C. Wood. The application of a new photoelectric method to the determination of the optical constants of some pure metals . . 932

J. Bor, A. Hobson and C. Wood. The optical constants of copper-nickel alloys . 942

J. Crank, D. R. Hartree, J. Ingham and R. W. Sloane. Distribution of potential in cylindrical thermionic valves 952

R. L. Moore. The reception of broadcast signals subject to disturbance by atmospherics 972

K. G. Emeleus, R. H. Sloane and Eliza B. Cathcart. Excitation of the green auroral line of oxygen 978

R. F. Barrow. A reinvestigation of the ultra-violet band system of carbon monoselenide 989

J. Thewlis. The examination of dental enamel by x rays and the polarizing microscope 992

R. S. Vincent and A. Simons. The thermal manometer, a new device for recording low absolute pressures 1003

G. Morris. The electrification of powders by free fall 1010

A. R. Hogg. The intermediate ions of the atmosphere 1014

F. L. Uffelmann. An accurate hard-valve counter chronograph . . . 1028

B. K. Johnson. An achromatic objective for use in ultraviolet microscopy . . 1035

Obituary notices:

Professor Frederick John Cheshire 1040

J. Edgar Crackston 1041

Sir Frank Dyson 1042

R. Kanthack 1044

Louis Lownds 1044

Alfred William Porter 1045

Frank Charles Watts 1047

Dr A. E. H. Tutton 1048

Reviews of books 1049

Index to volume 51 1061

PROCEEDINGS AT THE MEETINGS OF THE PHYSICAL SOCIETY

SESSION 1938–39

Except where the contrary is stated, the meetings were held at the Imperial College of Science and Technology, South Kensington, the President being in the Chair

14 *October* 1938

It was announced that the Council had elected the following to be Student Members: Derek Gordon Gay, William Roy Piggot, Joan Una Spellman, I. H. Usmani, Kenneth Weekes.

The following papers were read:

"The critical-frequency method of measuring upper-atmospheric ionization", by E. V. APPLETON, F.R.S., R. NAISMITH and L. J. INGRAM.

"The atmospheric height-distribution of band-absorbed solar radiation", by S. CHAPMAN, F.R.S., M.A., D.Sc.

"The limiting polarization of medium waves reflected from the ionosphere", by T. L. ECKERSLEY, F.R.S. and G. MILLINGTON, M.A.

"The origin of radio-wave reflections in the troposphere", by J. H. PIDDINGTON, M.Sc., B.E., Ph.D. (The paper was read by J. P. ANDREWS, D.Sc.)

The following papers were read in title:

"A concave-grating vacuum spectrograph for the wave-length 15 to 1000 A.", by F. C. CHALKLIN, D.Sc., S. S. WATTS, B.Sc. and S. P. HILLSON, B.Sc.

"The focusing properties of the electrostatic field between two cylinders", by F. H. NICOLL, Ph.D.

"The accuracy of rectifier-photoelectric cells", by J. R. ATKINSON, N. R. CAMPBELL, E. H. PALMER and G. T. WINCH.

"Note on the use of probability paper", by E. W. H. SELWYN.

"The relation between range and energy for upper limits of β-ray spectra", by E. E. WIDDOWSON, M.Sc.

"The integration of large numbers of x-ray crystal reflections", by R. H. V. M. DAWTON, B.Sc., A.Inst.P.

"The analogy between the photon and the electron and the derivation of the quantum equation", by H. T. FLINT, D.Sc., Ph.D.

A cinema film illustrating radio exploration of the ionosphere was shown by Mr R. NAISMITH of the Radio Research Station.

28 *October* 1938

The following were elected to be Fellows: D. V. Gogate, K. L. Narasimham, J. M. Nuttall, E. M. Williamson.

It was announced that Council had elected the following to be Student Members: K. Alsop, M. D. Armitage, H. A. Buchdahl, S. W. Cousins, P. J. Duncton, H. S. Griffin, A. B. Hammond, D. M. Heller, R. J. Hercock, D. M. Millest, G. W. A. Morris, D. C. Nutting, W. T. S. Pearson, J. Reekie, E. L. Ripley, R. F. Saxe, A. Stratton.

The following papers were read:

"Transmission of sound between neighbouring rooms in a brick building", by J. E. R. Constable, M.A., Ph.D.

"Specific inductance capacity of diamonds by the method of mixtures", by S. Whitehead, M.A., Ph.D., A.M.I.E.E., F.Inst.P. and W. Hackett.

The following papers were read in title:

"The precision measurement of capacitance", by N. F. Astbury, M.A., F.Inst.P. and L. H. Ford, M.Sc.

"Ferromagnetic compounds of chromium", by L. F. Bates, D.Sc., Ph.D., F.Inst.P. and G. G. Taylor.

"Analysis of light scattered from a surface of low gloss into its specular and diffuse components", by W. W. Barkas, M.Sc.

"A note on the near ultra-violet band system of SnO", by W. Jevons, D.Sc., Ph.D., F.Inst.P.

The following demonstration was given:

Electrical synthesis of bell tones. (The John Compton Organ Company, Ltd.)

---

11 *November* 1938

A. M. G. Thom was elected to be a Fellow.

It was announced that Council had elected the following to be Student Members: I. I. Berenblut, T. J. Buchanan, W. P. Fletcher, B. Kalakicha, G. F. Komlosy, A. C. Merrington, L. E. Mussell, T. Pearcey, E. J. Ryder, A. C. Shearman, B. S. Smith.

The Twenty-third Guthrie Lecture was delivered by Professor A. V. Hill, O.B.E., M.A., Sc.D., M.D., Sec.R.S., who took as his subject "The transformations of energy and the mechanical work of muscles".

The following papers were read in title:

"The characteristic temperature of magnesium oxide", by G. W. Brindley, M.Sc., Ph.D. and P. Ridley, B.Sc.

"An x-ray investigation of atomic vibrations in cadmium", by G. W. Brindley, M.Sc., Ph.D. and P. Ridley, B.Sc.

"Theoretical ionization curves for the E region", by M. V. Wilkes, M.A.

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25 *November* 1938

The following were elected to be Fellows: R. P. Abraham, J. D. Bernal, J. F. Wood.

It was announced that Council had elected the following to be Student Members: H. A. Dell, J. W. Leech, D. E. Lewis, B. E. Noltingk, A. G. Stainsby, J. L. Tearle, W. W. Wright, T. H. Wang.

The following papers were read:

"Acoustic spectra by the diffraction of light from sound films", by D. BROWN, Ph.D. (The paper was read by Dr W. D. WRIGHT.)

"The extinction of discharges in Geiger-Muller counters", by A. NUNN MAY, Ph.D.

The following papers were read in title:

"The rate of viscous flow of metals: Part II, lead", by L. C. TYTE, Ph.D., F.Inst.P.

"The thermal and electrical conductivities of carbon and graphite to high temperatures", by R. W. POWELL, B.Sc., Ph.D. and F. H. SCHOFIELD, B.A., D.Sc.

"The variation with temperature of the electrical resistance of carbon and graphite between 0° and 900° C.", by L. J. COLLIER, D.F.C., M.A., W. S. STILES, Ph.D. and W. G. A. TAYLOR.

"The scattering of fast β particles by xenon nuclei", by R. L. SEN GUPTA, M.Sc.

The following demonstration was given:

A normal-incidence vacuum grating spectrograph and a small heavy-current hydrogen discharge tube, by W. R. S. GARTON, B.Sc., A.R.C.S.

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9 *December* 1938

The meeting was held at 7 p.m., at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C. 2.

The meeting took the form of a joint discussion with the Meter and Instrument Section of the Institution of Electrical Engineers.

Dr C. V. DRYSDALE, C.B., O.B.E., M.I.E.E. opened the discussion, of which the subject was "Electro-acoustics".

---

20 *December* 1938

M. Blackman, H. A. T. Dyke-Hart, A. D. Misener and W. Railston were elected to be Fellows.

It was announced that Council had elected the following to be Student Members: W. D. H. Blackman, F. D. Brown, A. Horseman, J. Hutchinson, D. G. Jones,

G. F. G. Knipe, H. R. L. Lamont, B. P. Mullins, S. Paterson, A. W. Pryce, W. C. Morgan.

An address on "The structure of proteins" was delivered by IRVING LANGMUIR, M.A., D.Sc., LL.D., For.Mem.R.S.

The following papers were read in title:

"Emission of negative ions from oxide cathodes", by L. F. BROADWAY, Ph.D. and A. F. PEARCE, Ph.D., A.Inst.P.

"The conductivity of thin films of thallium on a pyrex-glass surface", by J. R. BRISTOW.

"The band spectrum of antimony fluoride (SbF)", by H. G. HOWELL, Ph.D. and G. D. ROCHESTER, Ph.D.

"The adsorption of oxygen and hydrogen on platinum, and their removal by positive-ion bombardment", by C. W. OATLEY.

"The investigation of electron lenses", by O. KLEMPERER, D.Sc. and W. D. WRIGHT, A.R.C.S., D.Sc.

3, 4, 5 *January* 1939

The Twenty-ninth Annual Exhibition of Scientific Instruments and Apparatus was held at the Imperial College of Science and Technology.

The following discourses were delivered:

"The cyclotron and its applications", by J. D. COCKCROFT, M.A., M.Sc., F.Inst.P., F.R.S., on Tuesday, 3 January 1939.

"Geophysical research in polar regions", by C. S. WRIGHT, C.B., O.B.E., M.A., on Wednesday, 4 January 1939.

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13 *January* 1939

The prizes and certificates awarded for the Tenth Competition in Craftsmanship and Draughtsmanship were presented.

An address on "Physics and physicists of the eighteen-seventies" was delivered by Sir J. AMBROSE FLEMING, M.A., D.Sc., F.R.S., who in 1874 read the first paper at the inaugural meeting of the Society.

The following papers were read in title:

"A study of the atmospheric corrosion of metals and alloys at different temperatures by electron diffraction", by M. BOUND, Ph.D. and D. A. RICHARDS, M.Sc., A.R.C.S.

"The effect of cooling and of magnetic fields on crystal rectification", by M. A. EL SHERBINI, M.Sc., Ph.D. and Y. L. YOUSEF, B.Sc.

"Some investigations of the spectral sensitivity of selenium-rectifier photoelectric cells", by G. P. BARNARD, B.Sc., A.Inst.P.

"Ultra-violet band systems of silicon monoselenide and monotelluride", by R. F. BARROW, B.Sc.

"Apparatus for electron-diffraction at high temperatures", by R. JACKSON and A. G. QUARRELL, B.Sc., Ph.D., F.Inst.P.

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27 *January* 1939

F. W. Chapman and H. L. Green were elected to be Fellows. The following were transferred from student membership to fellowship: G. L. J. Bailey, P. S. Brown, A. H. Cooke, R. C. Parker, D. H. Parnum.

It was announced that Council had elected the following to be Student Members: R. A. Day, G. E. F. Fertel, C. G. Fitzpatrick, H. Hutchinson, A. C. Reid, S. G. Tomlin.

The meeting took the form of a joint discussion with the Royal Astronomical Society on "The expanding universe", opened by Professor G. TEMPLE and Dr G. C. MCVITTIE.

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10 *February* 1939

L. H. Bainbridge-Bell, E. A. Guggenheim and A. H. Haworth were elected to be Fellows of the Society. The following were transferred from student membership to fellowship: G. E. Ashwell, R. Bruce, E. W. Foster, K. A. Harwood, G. J. Kynch, J. L. Michiels, I. W. Ramsay, E. E. Widdowson.

The following papers were read:

"Note on the bar pendulum", by D. OWEN, B.A., D.Sc., F.Inst.P. With demonstration.

"Simple demonstration of the Peltier effect with approximate measurement", by A. CAMPBELL, M.A. With demonstration by L. HARTSHORN, D.Sc.

"Further measurement of the thermal and electrical conductivity of iron at high temperatures", by R. W. POWELL, Ph.D.

The following papers were read in title:

"Mutual and self inductors compensated for change of frequency", by A. CAMPBELL, M.A.

"The electrical resistance of nickel amalgams", by L. F. BATES, D.Sc., F.Inst.P. and J. H. PRENTICE, B.Sc.

"An x-ray study of lattice distortion in copper, nickel and rhodium", by G. W. BRINDLEY, M.Sc., Ph.D. and P. RIDLEY, Ph.D.

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24 *February* 1939

K. H. Waters and E. J. Whitmore were transferred from student membership to fellowship, and E. T. Purslow was elected to be a Fellow.

It was announced that Council had elected D. S. Box and G. R. Nicholson to be Student Members.

The following papers were read:

"The diffraction of electrons by anthracene", by A. CHARLESBY, G. I. FINCH, F.R.S. and H. WILMAN, Ph.D.

"Theory of the width of rings formed by electron-diffraction", by G. P. THOMSON, M.A., F.R.S. and M. BLACKMAN, M.Sc., Ph.D.

"Apparatus for electron-diffraction at high temperatures", by R. JACKSON and A. G. QUARRELL, Ph.D., F.Inst.P.

The following paper was read in title:

"Spreading of paraffin oils containing fatty acids on aqueous solutions of calcium ions", by E. H. MERCER.

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10 *March* 1939

Annual General Meeting

The minutes of the previous Annual General Meeting were read and accepted as correct.

The reports of the Council and the Hon. Treasurer were adopted.

The officers and Council for 1939–40 and the auditors were elected.

Votes of thanks were accorded to the retiring officers and Council and to the Governors of the Imperial College of Science and Technology.

Extraordinary General Meeting

Professors P. Debye and J. Perrin were elected to be Honorary Fellows.

Ordinary Meeting

H. Kolsky was transferred from student membership to fellowship, and J. Sayers and K. E. Spells were elected to be Fellows.

The following paper was read:

"A falling-weight time switch: its standardization and application to the determination of the time constant of an inductive circuit", by E. J. IRONS, Ph.D., F.Inst.P. and G. A. BENNETT, B.Sc.

The following papers were read in title:

"On the theory of electronic semi-conductors", by B. R. A. NIJBOER.

"Shear-stress systems and combined stress", by J. J. GUEST.

A demonstration of the Volta contact electromotive force was given by J. NICOL, B.A., B.Sc.

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24 *March* 1939

Geoffrey Wilmot Lobb was elected to be a Fellow.

The Sixteenth Duddell Medal was presented to Mr Robert W. Paul, M.I.E.E.

The Thomas Young Oration was delivered by Major-General M. N. Macleod, D.S.O., M.C., A.D.C., of the Ordnance Survey, Southampton, who took as his subject "Some recent developments in British surveying instruments".

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20 *April* 1939

An evening meeting was held at the British Scientific Instrument Research Association, 26 Russell Square, London, W.C. 1, by kind invitation of Mr A. J. Philpot, Director of Research and Secretary.

Exhibits of graticules and coloured eyeshell glasses were arranged by the B.S.I.R.A.

A discussion on "Lens computing" was opened by L. J. Comrie, M.A., Ph.D.

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28 *April* 1939

A. A. Nasr and Evan James Williams were elected to be Fellows. It was announced that Council had elected Edward Victor Denis Glazier to be a Student Member.

The following paper was read:

"A new method of creating electrification", by Sir Ambrose Fleming, M.A., D.Sc., F.R.S. With demonstration.

The following papers were read in title:

"Ultra-high-frequency resonances in the positive-grid triode", by A. C. Chipman.

"Measurements of the intensity-distribution of the white x radiation reflected from a crystal; with a note on the dispersion of the atomic scattering factor of zinc near the *K* absorption edge", by J. C. M. Brentano, J. Honeyburne and J. K. Berry.

"The third spark spectrum of krypton, Kr IV", by A. B. Rao and S. G. Krishnamurty.

"CN and AlO bands in the carbon arc", by N. R. Tawde and S. A. Trivedi.

A demonstration of the preparation and properties of photo-conductive crystals of the alkali halides was given by W. R. S. Garton, B.Sc., A.R.C.S.

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4 *May* 1939

The meeting was held in the lecture theatre of the Royal Institution, 21 Albemarle Street, London, W. 1, by the courtesy of the Managers, and took the form of a joint discussion with the Chemical Society and the Royal Meteorological Society on "The upper atmosphere."

Professor F. A. PANETH, Ph.D. opened the discussion and spoke on "Direct chemical investigations".

The following also took part, and at the end of their contributions the subject was thrown open to general discussion:

Professor S. CHAPMAN, F.R.S. "Spectroscopic and other evidence as to chemical composition and dissociation."

Dr G. M. B. DOBSON, F.R.S. "The vertical distribution of ozone."

Dr F. J. W. WHIPPLE, M.A. "Direct measurements and sound evidence."

Professor F. A. LINDEMANN, F.R.S. "Meteor evidence."

Professor E. V. APPLETON, F.R.S. "Radio evidence."

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12 *May* 1939

Harry Schecter was transferred from student membership to fellowship, and George Henry Briggs and David Brunt were elected to be Fellows.

The following paper was read:

"A machine for the rapid summation of Fourier series", by C. A. BEEVERS, D.Sc., F.Inst.P. With demonstration.

A discussion followed this paper and was opened by L. J. COMRIE, M.A., Ph.D.

The following paper was read:

"The structure of silver films", by O. GOCHE and H. WILMAN, Ph.D., F.Inst.P.

The following papers were read in title:

"The reproducibility of the platinum thermocouple at the freezing points of gold, silver and antimony", by M. DE SELINCOURT, B.A.

"Sensitivity of photographic films to X-radiation at very low temperatures", by J. REEKIE.

"Comparison of cosmic-ray showers underground and at sea-level", by D. H. FOLLETT, M.A., F.Inst.P.

"A note on the structure of insulin", by I. LANGMUIR and D. WRINCH.

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26 *May* 1939

The meeting was held in the Physics Department, Bedford College, Regent's Park, N.W. 1, by kind invitation of Professor W. Wilson.

Christopher Noel Hunter Lock and Percival Albert Sheppard were elected to be Fellows, and Thomas Henry Redding was transferred from student membership to fellowship.

It was announced that Council had elected Henry Llewellyn Hackforth and Bernard W. Soole to student membership.

The following papers were read:

"On the scattering of β particles by atomic nuclei", by W. T. Davies, M.A.

"The Principles of Fermat and Hamilton", by W. Wilson, F.R.S.

The following papers were read in title:

"Note on the confirmation of the height-gain diffraction analysis on medium waves", by T. L. Eckersley, F.R.S. and G. Millington, M.A.

"The effect of the Lorentz polarization term in ionospheric calculations", by J. A. Ratcliffe, M.A.

"Potential distribution in cylindrical thermionic valves", by J. Crank, D. R. Hartree, F.R.S., J. Ingham and R. W. Sloane.

"A new method of determining the properties of dielectrics at centimetre wave-lengths", by M. Velasco, D.Sc. and G. L. Hutchinson, Ph.D.

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3 *June* 1939

By kind permission of Professor A. C. Menzies, M.A., D.Sc., of the Physics Department of University College, Southampton, and Major-General M. N. MacLeod, D.S.O., M.C., A.D.C., Director of the Ordnance Survey Office, a meeting was held at Southampton. The programme was as follows:

1. (*a*) Introductory address, and

(*b*) The spectroscopic work of the Physics Laboratory, by Professor A. C. Menzies, M.A., D.Sc.

(*c*) Work on molecular spectra, by H. G. Howell, Ph.D.

(*d*) Determination of specific heats of metals at extreme temperatures, by T. F. Harle, B.Sc.

2. (*a*) Measurement of surface tension by a drop-volume method with a micrometer syringe, and

(*b*) Experiments on surface films, by Professor N. K. Adam, M.A., Sc.D., F.R.S. and J. S. F. Gill, B.Sc.

3. The work of the Engineering Department, by Professor T. R. Cave-Brown-Cave, C.B.E.

4. Demonstrations and exhibits in the laboratories by members of the staffs.

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9 *June* 1939

George Ronald Cooper and Walter S. C. Watkins were elected to be Fellows.

The following papers were read:

"A mechanical model illustrating the principle of the cyclotron", by F. A. B. WARD, M.A. Ph.D. With demonstration.

"Atmospheric disturbances due to thundercloud discharges", by F. W. CHAPMAN, Ph.D.

"Vibrations of free square plates. Part I: Normal vibrating modes", by MARY D. WALLER, B.Sc., F.Inst.P.

The following papers were read in title:

"The gamma-ray measurement of radium", by T. H. ODDIE, M.Sc.

"The application of a new photoelectric method to the determination of the optical constants of some pure metals", by J. BOR, A. HOBSON and C. WOOD.

"The optical constants of copper-nickel alloys", by J. BOR, A. HOBSON and C. WOOD.

"The electrical resistance of ferromagnetic amalgams", by L. F. BATES, D.Sc., Ph.D., F.Inst.P. and W. P. FLETCHER.

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23 *June* 1939

The following papers were read:

"The velocity-distribution in a liquid-into-liquid jet. Part II: The plane jet", by E. N. DA C. ANDRADE, F.R.S.

"The relative luminosity of radiation for the average photometric observer, Part II", by J. S. PRESTON, M.A.

The following papers were read in title:

"Oblique refraction through a cylinder", by H. W. LEE, B.A.

"Some investigations on the influence of the angle of light incidence on the light diffraction by supersonic waves", by E. A. NEUMANN, D.Phil.

"The diurnal variation of absorption of wireless waves", by F. W. G. WHITE, M.Sc., Ph.D. and T. W. STRAKER, M.Sc.

"The intermediate ions of the atmosphere", by A. R. HOGG, M.Sc.

"Note on the dispersion of a prism", by F. E. SUTTON, B.Sc. and A. HARVEY, Ph.D.

"Further results on the magnetism of the palladium and platinum triads of elements", by B. CABRERA and A. DUPERIER.

A demonstration of the winding and adjustment of resistance coils of precision was given by D. C. GALL, F.Inst.P.

11, 12, 13 *July* 1939

An informal conference on internal strains in solids was held at the H. H. Wills Physical Laboratory, University of Bristol, under the joint auspices of the Physical Society and the University of Bristol.

The following subjects were discussed:

"Slip in metal crystals."

"Diffusion in solids."

"Precipitation hardening."

"Recrystallization and effect of grain size on mechanical properties of solids."

"Internal friction in solids."

"The magnetization curve of ferromagnetic materials."

The following took part in the discussion: E. N. da C. Andrade, R. Becker, A. J. Bradley, W. L. Bragg, G. W. Brindley, J. M. Burgers, W. G. Burgers, B. Chalmers, P. Ewald, G. I. Finch, M. Gayler, H. Jones, J. E. Lennard-Jones, D. A. Oliver, E. Orowan, G. D. Preston, E. C. Stoner, C. Sykes, G. I. Taylor, W. A. Wood.

REPORT OF COUNCIL FOR THE YEAR ENDING 28 FEBRUARY 1939

ANNUAL GENERAL MEETING

An annual general meeting was held at the Imperial College of Science and Technology on 11 March 1938, for the presentation and adoption of the Reports of the Council and the Honorary Treasurer and for the election of Officers and Council.

SCIENCE MEETINGS

During the period under review twenty science meetings were held, of which seventeen were occupied by demonstrations, papers and discussions, and three by the Guthrie Lecture and special Addresses. Twelve demonstrations were given, 27 papers were read and discussed, and 55 papers were read in title only, the total number of papers presented being larger by eighteen than in the corresponding period of 1937–38.

Sixteen of the meetings took place in the Physics Department of the Imperial College, by kind permission of the Rector and Governing Body and of Professor G. P. Thomson; one meeting for papers on optical subjects alone was held in the evening of 2 June 1938 in the rooms of the Royal Society, by the courtesy of the President and Council; and a science meeting was held in the lecture theatre of the Cavendish Laboratory on the occasion of the visit to Cambridge on 18 June 1938, by the kind invitation of the Acting Director, Professor E. V. Appleton.

Three of the meetings were held jointly with other Societies for the discussion of selected subjects: (i) with the Chemical Society in the rooms of that Society, Burlington House, on 17 March 1938, for a discussion on "Electron diffraction and surface structure", opened by Professor G. I. Finch; (ii) with the Meter and Instrument Section of the Institution of Electrical Engineers, at the Institution, Savoy Place, on 9 December 1938, for a discussion on "Electro-acoustics", opened by Dr C. V. Drysdale; and (iii) with the Royal Astronomical Society, at the Imperial College on 27 January 1939, for a discussion on "The expanding universe", opened by Professor G. Temple and Dr G. C. McVittie.

The programme card for the session 1938–39 represents a departure from previous practice in that it indicates in advance the nature of the scientific business to be transacted at each meeting in the session.

The Council has recently decided that in the session 1939–40 two or more evening science meetings will be held at centres outside London.

SUMMER MEETING AT CAMBRIDGE

The Summer Meeting took place at Cambridge on 18 June 1938, when three parties of members of the Society and their friends visited (i) the Radio Research Field Station and the Solar Physics Observatory, by invitation of Professor E. V. Appleton and Professor F. J. M. Stratton, (ii) the works of the Cambridge Instrument Company, Ltd., by the courtesy of the Directors, and (iii) the Cambridge University Press, by kind invitation of the Syndics. Lunch was taken at St John's College, by kind permission of the Master and Fellows. A science meeting was held at the Cavendish Laboratory, where short addresses were given by Professor E. V. Appleton, Dr J. D. Cockcroft and Mr P. I. Dee. This was followed by a tour of the Cavendish and Royal Society Mond Laboratories arranged by Mr J. A. Ratcliffe, during which demonstrations of the high-voltage installation, the cyclotron, and the cryogenic and other investigations in the laboratories were given by members of the staff.

GUTHRIE LECTURE

The twenty-third Guthrie Lecture was delivered on 11 November 1938 at the Imperial College by Professor A. V. Hill, who took as his subject "The transformations of energy and the mechanical work of muscles".

SPECIAL ADDRESSES

An Address on "The structure of proteins" was given by Dr Irving Langmuir on 20 December 1938; it was followed by a discussion.

An Address on "Physics and physicists of the eighteen-seventies" was given on 13 January 1939 by Sir Ambrose Fleming, who is now the only survivor of the ninety-nine original members of the Physical Society of London, and who had read the first paper at its inaugural meeting on 21 March 1874. This paper is being reprinted, together with the Address, in the present volume of the *Proceedings*. The Address was recorded by the British Broadcasting Corporation, and parts of it were broadcast later in the evening.

DUDDELL MEDAL

The fifteenth Duddell Medal, the award of which was announced in the previous report of the Council, was presented on 13 May 1938 to Professor Hans Geiger of Tübingen University in recognition of his invention and subsequent improvement of his ionization counters.

The Council has awarded the sixteenth Duddell Medal to Mr Robert W. Paul for his work on the invention and design of scientific instruments and apparatus, notably the type of intermittent motion commonly used in cinematograph projection, unipivot electrical measuring instruments, and the Bragg-Paul pulsator for prolonged artificial respiration.

CHARLES CHREE MEDAL AND PRIZE

Through the generosity of Miss Jessie S. Chree of Edinburgh, a memorial to her brother, the late Charles Chree, Sc.D., F.R.S., a Past President of this Society, is to be founded. It is to take the form of an award known as the Charles Chree Medal and Prize, which is to be made, without restriction as to nationality, at intervals of not less than two years for distinguished research in one or more of the branches of knowledge in which Dr Chree was especially interested. At Miss Chree's request the Council has undertaken to administer the prize fund and make the award from time to time, and has appointed a committee to consider the regulations which shall govern the award.

HERBERT SPENCER BEQUEST

During the period under review the Council has received and considered one application for a research grant from a Fellow of the Society. No grant has been made.

The neutron source, which, as was stated in the previous report, the Council had decided to purchase, was received in June 1938 and loaned to Professor G. P. Thomson. It consists of 100 milligrammes of radium in the form of the chloride mixed with 600 milligrammes of beryllium in a sealed monel metal container.

About 20 volumes have been purchased for the Joint Library of the Physical Society and the Institute of Physics.

PROGRESS REPORTS

Volume 5, which was recently published, is even more comprehensive in scope than the four preceding volumes. The sales of Volumes 3 and 4 have been highly satisfactory. The stock of copies of Volumes 1 and 2 is exhausted; copies of these volumes offered for sale in good condition will be repurchased by the Society.

ANNUAL EXHIBITION

The Twenty-ninth Annual Exhibition of Scientific Instruments and Apparatus was held on 3, 4 and 5 January 1939 at the Imperial College, by the courtesy of the Governing Body. The attendance during the three days was about 8700.

Eighty-one firms exhibited their products in the Trade Section; in addition three firms displayed technical literature. The Research and Educational Section contained contributions from twenty-seven University laboratories, research associations, Government and industrial laboratories, and private individuals. As in previous years, an Apprentices' and Learners' Competition in craftsmanship and draughtsmanship was held in conjunction with the exhibition, and the work entered for the competition was on view. The prizes and certificates awarded in the competition were presented to successful candidates at the meeting on 13 January 1939.

The following discourses were delivered during the exhibition:

"The cyclotron and its applications", by J. D. Cockcroft, M.A., Ph.D., F.R.S.

"Geophysical research in polar regions", by C. S. Wright, C.B., O.B.E., M.A.

As in previous years, permission was given to the Institute of Physics to publish these discourses in the February number of the *Journal of Scientific Instruments*.

PEDAGOGIC PAPERS

The Council has decided that papers dealing with matters of a purely pedagogic nature may be accepted for publication in the *Proceedings*, provided that they do not exceed four pages (about 2200 words) and are of the standard of University instruction. As far as possible these papers will be grouped together in one part of each volume of the *Proceedings*.

REPRESENTATION OF THE SOCIETY

The Physical Society has been represented on other bodies as follows:

British National Committee for Physics: Mr J. H. Awbery, Mr T. Smith, Professor A. M. Tyndall.

British National Committee for Scientific Radio: Professor E. V. Appleton, Professor L. S. Palmer.

Committee of Management of Science Abstracts: Professor A. Ferguson, Mr J. H. Awbery, Dr W. Jevons, Dr D. Owen.

Board of the Institute of Physics: Dr D. Owen, Dr A. B. Wood.

British Standards Institution Committee for Photographic Standardisation and Preparation of Standards for Sensitometry: Dr R. W. B. Pearse.

British Standards Institution Committee on Methods for the Measurement of Flow and Pressure of Gases and of Temperature: Dr E. Griffiths.

British Standards Institution Committee on Units and Data: Dr H. T. Flint.

Geophysical Committee of the Royal Astronomical Society: Dr F. J. W. Whipple.

Joint Deputation to the Postmaster General regarding the Suppression of Electrical Interference with Radio: Professor E. V. Appleton, Professor G. I. Finch, Dr D. Owen.

The Society has also been represented at the following functions:

British Standards Institution Conference on the Standardisation of Insulation and Hardboard, 24 March 1938: Mr J. H. Awbery.

Benjamin Franklin Celebrations at the Franklin Institute, Philadelphia, 19–21 May 1938: Professor W. F. G. Swann.

University of St Andrews Celebration on 5 July 1938 of the 300th Anniversary of the Birth of Professor James Gregory: Professor E. Taylor Jones.

La Semaine Internationale contre le Cancer, 23–30 November, in Paris, for the commemoration of the discoveries of Radium, Hertzian Waves, x Rays and Electrons: Professor G. P. Thomson.

OBITUARY

The Council records with deep regret the deaths of Dr C. E. Guillaume and Dr G. E. Hale, who were Honorary Fellows; and of the following Fellows: Mr D. Baxandall, Monsieur A. Callier, Mr A. M. Codd, Dr J. E. R. Constable, Mr P. A. Cooper, Mr R. Kanthack, Dr L. Lownds, Sir Robert Mond, Professor A. W. Porter, Dr S. Rideal, Mr F. R. C. Rouse, Professor W. Stroud, Mr T. Smithies Taylor, Dr A. E. H. Tutton.

MEMBERSHIP ROLL AT 31 DECEMBER 1938

	Total 31 Dec. 1937	Changes during 1938			Total 31 Dec. 1938
Honorary Fellows	11	Deceased		2	9
Honorary Fellows (Optical Society)	7			–	7
Ex-officio Fellows	4			–	4
Ordinary Fellows	940	Elected		40	
		Student transfers ...		6	
				46	
		Deceased	14		
		Resigned or lapsed ...	32		
				46	
		Net change		–	940
Student Members	79	Elected		33	
		Transferred	6		
		Resigned or lapsed ...	15		
				21	
		Net change		12	91
Total Membership	1041	Net increase		10	1051

REPORT OF THE HONORARY TREASURER FOR THE YEAR ENDED 31 DECEMBER 1938

THE accounts show an excess of expenditure over income of £122. 6*s*. 8*d*. This is largely accounted for by the increase in the cost of printing and steps have been taken to effect economies in this direction. The publication of the *Annual Reports on Progress in Physics* has continued without charge on the general funds of the Society.

The unexpended balance of the Herbert Spencer Bequest now amounts to £581. 17*s*. 0*d*., of which about £543 has been allocated.

No change has been made in the Society's investments. These have been valued at market prices on 31 December 1938, through the courtesy of the Manager of the Charing Cross Branch of Westminster Bank, Ltd.

(Signed) C. C. PATERSON

Honorary Treasurer

2 *March* 1939.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 DECEMBER 1938

1937 £ s. d.	Expenditure	£ s. d.	£ s. d.
	To		
486 0 0	"Science Abstracts"		328 14 2
	Normal Publications:		
2109 2 4	"Proceedings" and Exhibition Catalogue	2418 18 2	
40 2 9	Notices	65 9 9	
194 16 9	Editorial and General Expenses	182 13 1	
			2667 1 0
	Special Publications:		
837 15 1	"Reports on Progress in Physics" (Vol. IV)	800 18 2	
	Other Publications	7 15 8	
			808 13 10
333 7 0	Postage on Normal Publications and General Correspondence		373 4 10
35 13 1	Expenses at Meetings		24 11 3
13 19 9	Periodicals and Library		17 5 11
	Institute of Physics:		
608 16 0	Clerical Assistance and Office Expenses	604 17 0	
302 3 9	Electricity, Labour and Sundries in connexion with Exhibition	337 10 2	
			942 7 2
4 12 11	Summer Visit		18 11 10
20 0 0	Honoraria to Lecturers		40 0 0
	Printing and Circulating List of Members		52 17 1
142 9 3	Sundry Expenses		218 5 0
92 12 10	*Balance, being excess of Income over Expenditure, carried forward to Accumulated Fund*		
£5221 11 6			£5491 12 1

1937 £ s. d.	Income	£ s. d.	£ s. d.
	By		
	Subscriptions:		
29 8 0	Entrance Fees	38 17 0	
1678 13 8	Fellows*	1678 5 1	
4 4 0	Voluntary†	3 3 0	
38 6 0	Students	43 11 6	
117 8 10	For "Science Abstracts" and Advance Proofs	111 8 2	
			1875 4 9
91 0 0	Transfer from Life Composition Fund of amounts paid by Fellows now deceased		72 0 0
	Sales:		
930 17 6	Normal Publications	900 1 3	
8 9 1	International Conference Reports	5 2 4	
739 2 11	"Progress Reports"	843 9 3	
			1748 12 10
444 0 0	Advertisements in Publications		471 16 7
	Dividends from Investments	295 15 7	
	Less Transfer to Duddell Memorial Fund	14 0 0	
298 19 9			281 15 7
841 1 9	Exhibitors' and other payments on account of Exhibition		919 15 8
	Balance, being excess of Expenditure over Income, carried forward to Accumulated Fund		122 6 8
£5221 11 6			£5491 12 1

* Eighty-six Fellows paid reduced subscriptions by the arrangement with the Institute of Physics, the total rebate being £34. 4s. 0d.

† Voluntary subscriptions are subscriptions paid by Fellows who compounded for the low sum of £10.

BALANCE SHEET AS ON 31 DECEMBER 1938

BALANCE SHEET AS ON 31 DECEMBER 1938

Liabilities	£ s. d.	£ s. d.	£ s. d.
Sundry Creditors		1486 5 6	
Life Compositions:			
As on 31 December 1937	1464 10 0		
Add Payments during year	115 10 0		
	1580 0 0		
Less Transfer to Income and Expenditure Account of amounts paid by Fellows now deceased	72 0 0		
		1508 0 0	
Subscriptions received in advance:			
Members	40 3 1		
Publications	234 15 4		
		274 18 5	
			3269 3 11
Special Funds			
W. F. Stanley Trust Fund		228 0 0	
Duddell Memorial Trust Fund		397 16 9	
"Progress Reports" Reserve Account		83 1 0	
Herbert Spencer Legacy		581 17 0	
			1290 14 9
General Fund			
Accumulated Fund:			
As on 31 December 1937		3810 17 6	
Add Balance of Optical Convention, 1926, Trust Account		51 3 2	
		3862 0 8	
Less Decrease in value of Investments		593 0 0	
		3269 0 8	
Less Balance of Income and Expenditure Account		122 6 8	
		3146 14 0	
A. W. Scott Bequest		173 11 11	
			3320 5 11
			£7880 4 7

Assets	£ s. d.	£ s. d.	£ s. d.
Investments at Market Value on 31 December 1938:			
£2100 Consolidated Stock 2½ %	1480 0 0		
£1000 War Loan 3½ % Inscribed "A" Account	987 0 0		
£750 War Loan 3½ % Registered	739 0 0		
£650 Funding Loan 4 %	697 0 0		
£500 India 3½ % Stock	448 0 0		
£400 Lancaster Corporation 3 %	376 0 0		
£399 London Midland and Scottish Railway 4 % Debenture Stock	385 0 0		
£1000 London Midland and Scottish Railway 4 % Preference Stock	500 0 0		
£500 London and North Eastern Railway 4 % Debenture Stock	457 0 0		
£150 Southern Railway 5 % Debenture Stock	178 0 0		
£300 Southern Railway Preferred Ordinary Stock	172 0 0		
£442 Southern Railway Deferred Ordinary Stock	56 0 0		
£400 War Loan 3½ % Inscribed "B" Account	395 0 0		
			6870 0 0
Dividends due from Investments			37 12 0
Inland Revenue—Income Tax claimed for 1938			21 11 8
Subscriptions due			35 3 6
Sundry Debtors			357 9 8
Amounts paid in advance			18 5 6
Cash at Bank: Current	517 13 11		
Cash in Savings Bank Account	11 9 8		
Cash in hand	10 18 8		
			540 2 3
			£7880 4 7

NOTE: These accounts do not include the usual liabilities incurred in 1938 in respect of publications to be issued in 1939, amounting to approximately £1044.

Stock of publications at 31 December 1938. At Honorary Treasurer's valuation £1050 12 7

C. C. PATERSON, *Honorary Treasurer.*

We have audited the above Balance Sheet and have obtained all the information and explanations we have required. We have verified the bank balances and the Investments. In our opinion such Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Society's affairs according to the best of our information and the explanations given to us and as shown by the books of the Society.

SPENCER HOUSE, SOUTH PLACE, E.C. 2
1 *March* 1939.

KNOX, CROPPER & Co.,
Chartered Accountants.

LIFE COMPOSITION FUND ON 31 DECEMBER 1938

	£	s.	d.
38 Fellows paid £10	380	0	0
1 Fellow paid £15	15	0	0
14 Fellows paid £21	294	0	0
26 Fellows paid £31. 10s.	819	0	0
	£1508	0	0

SPECIAL FUNDS

W. F. STANLEY TRUST FUND

	£	s.	d.		£	s.	d.
Carried to Balance Sheet	228	0	0	£300 Southern Railway Preferred Ordinary Stock	172	0	0
				£442 Southern Railway Deferred Ordinary Stock	56	0	0
	£228	0	0		£228	0	0

DUDDELL MEMORIAL TRUST FUND

Capital

	£	s.	d.		£	s.	d.
Carried to Balance Sheet	395	0	0	£400 War Loan Inscribed "B" Account	395	0	0

Revenue

	£	s.	d.		£	s.	d.
Engraving Medal	2	2	0	Balance on 31 December 1937	5	18	9
Honorarium to Medallist	15	0	0	Interest	14	0	0
Balance carried to Balance Sheet	2	16	9				
	£19	18	9		£19	18	9

OPTICAL CONVENTION, 1926, TRUST ACCOUNT

	£	s.	d.		£	s.	d.
Transferred to Accumulated Fund	51	3	2	Balance on 31 December 1937	51	3	2

A. W. SCOTT BEQUEST

	£	s.	d.		£	s.	d.
Balance carried to Balance Sheet	173	11	11	Balance on 31 December 1937	173	11	11

"PROGRESS REPORTS" RESERVE ACCOUNT

	£	s.	d.		£	s.	d.
Balance carried to Balance Sheet	83	1	0	Balance on 31 December 1937	83	1	0

HERBERT SPENCER LEGACY

	£	s.	d.		£	s.	d.
Furniture and Library	44	16	10	Balance on 31 December 1937	1029	8	4
Purchase of radium	402	14	6				
Balance carried to Balance Sheet	581	17	0				
	£1029	8	4		£1029	8	4